7   Charts

Now we get to something most people find enjoyable. We will create charts. Long data series and tables can be extremely tedious to watch, and you can often make data more readable by visualizing them in a chart instead. Excel offers lots of possibilities to make some really nice graphs that can illustrate many different types of data.

In this book, we must first make a bar chart. The bar chart will be the basis for a series of exercises where we work with the various options and other things you can do with a chart. Then the other chart types will be described in outline, so you can experiment with adjusting them.

3D charts will not be reviewed in this book, because it is something you can easily figure out yourself once you have learned the basics of bar, basket and pie charts. 3D charts are beautiful and can really impress, but you should also be aware that they may be harder to read accurately. However, in a sales brochure are they do look good!

7.1   Bar Charts

To get started with charts, we need some data to work with. Create a spreadsheet similar to the one shown in Figure 91. We will use this spreadsheet for the next several exercises.

The spreadsheet is an energy accounting, which shows a random English family's consumption of heating oil and electricity over a year. The data are entirely fictional, and the task is not to come to any conclusions about the family's total CO_2 emissions!

	A	B	C	D
1				
2				
3			Oil in Liters	EL in kWh
4		January	425	480
5		February	410	486
6		March	378	370
7		April	198	388
8		May	66	365
9		June	68	370
10		July	61	328
11		August	62	379
12		September	73	398
13		October	112	402
14		November	250	465
15		December	410	512
16				

Figure 84: The spreadsheet we will use for our chart exercises.

Let us get started on our first chart! We need to make a bar chart".

1. Make sure one of the cells in the table is the active cell. Alternatively you can select the whole table.
2. Choose the **Insert** Tab in the Ribbon.
3. Click on the **Bar** button.
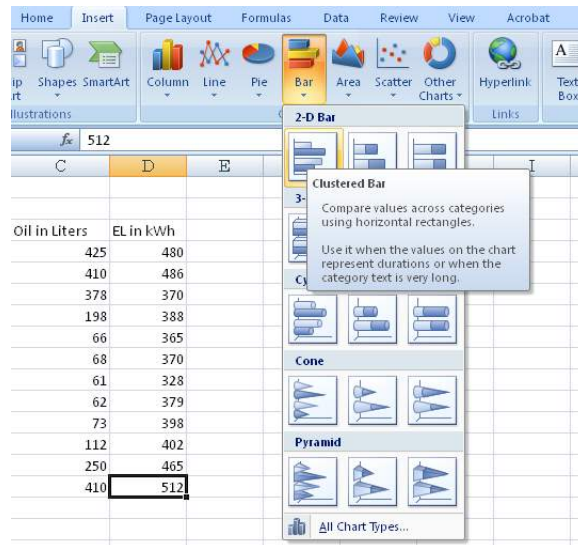4. Choose chart type top left (see Figure 85).

Figure 85: Choose your first chart.

Within a few seconds the miracle will happen. If you have followed my instructions correctly, you already have a neat chart ready for use. The graph has a horizontal axis with months and a series of bars in two different colours that show the oil and electricity consumption respectively.
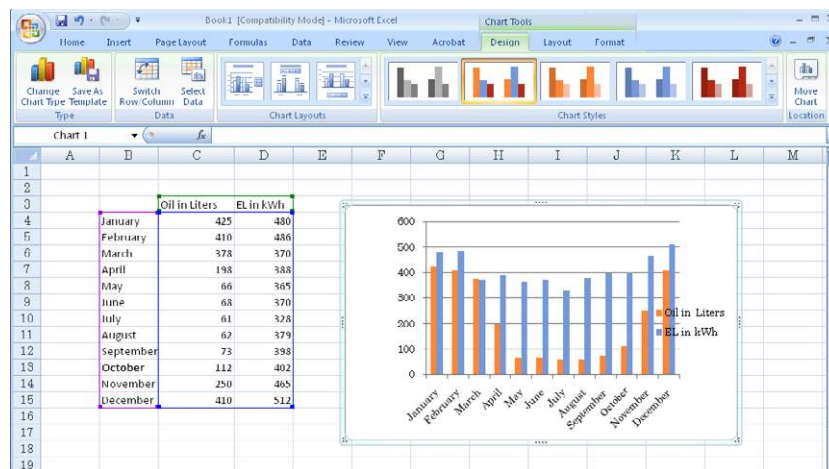

Figure 86: Your first bar chart. Notice the Ribbon has changed.

Unless you clicked on an empty cell in the spreadsheet, the chart will now be selected. If not, click one time with the mouse on the chart.

When a chart is selected, certain things happen. The table with data will be highlighted, so you can see which data are included in the chart. You can change the data to be included by pulling with the mouse at the corners of the selection.

7.1.1 Charting Tools and Language Confusion

When the chart is selected, some Tabs will be added to the band called "Charting Tools". The Charting Tools contain all the functions you can use on your charts. The tools are organised into three Tabs called **Design**, **Layout** and **Format**.

The **Ribbon** is a brand new way to use charts, and once you get used to it, it is a definite improvement on the endless number of dialog boxes in the older versions.

The **Design** Tab contains the basic functions to adapt the structure of the chart. Think of design as being about the basic structure without the colours, numbers formats, etc. It could be about what type of chart you want to use, the data to be included and how they should be interpreted. It can therefore be a little confusing that in the Design Tab we can select what colour Styles to match with the colour theme you have set for the spreadsheet.

The **Layout** Tab contains functions to manage the various elements of a chart. A chart can, for example, include a title, an explanation for the different column colours, gridlines, which helps make the chart easier to read, layout, etc. Thus layout is about the placement of the different elements that you can "stick" on a chart.

The **Format** Tab contains functions relating to the aesthetic part of the task, such as colouring, font, number formats etc.

7.1.2 Terminology – What does it mean?

There is some terminology and words and concepts you should know before you start working with charts. Figure 87 shows the chart from our exercise, with a few extra features added.
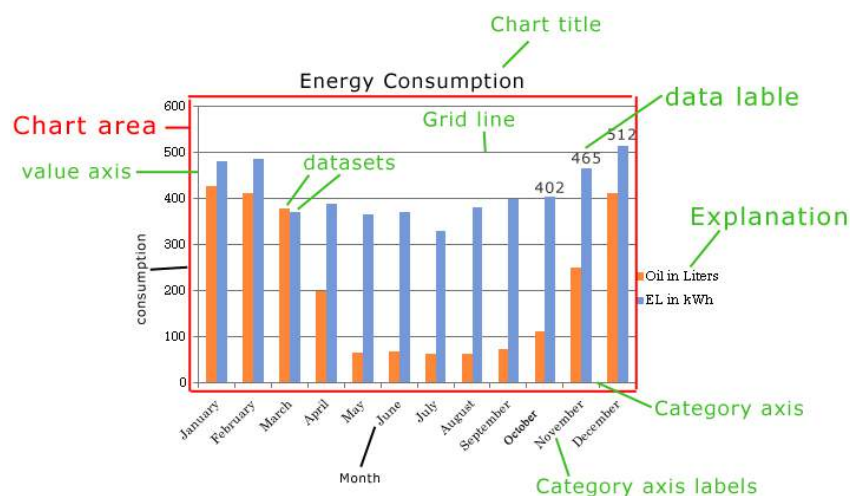

Figure 87: The most important elements in a chart.

"Data Series" is the name for the data displayed in the form of pillars. In this example we have two data series, namely "Oil in litres" and "Electricity consumption in kWh.

Everything can be adjusted in the chart. If you right-click an item a menu pops up where you can do different things. One detail is the data series. If you just right-click on a pillar in the data series, the changes you make affect the entire data series. However, if you click twice with the left mouse button on a pillar and then right-click, the changes will affect only the column you clicked.

7.1.3   Change of Scale

By default, Excel will adjust the scale of value axis. But sometimes it can be advantageous to create a fixed scale. This is especially true if you have two charts side by side, which must be comparable. If you make permanent scales on both charts, they are easy to compare. Another example is if you have a percent scale. Excel has a tendency to let it go up to 120%, although you might only want it to go to 100%.

1. Click with the right mouse button on one of the figures on the value axis.
2. A menu appears, and you must click on **Format axis**.
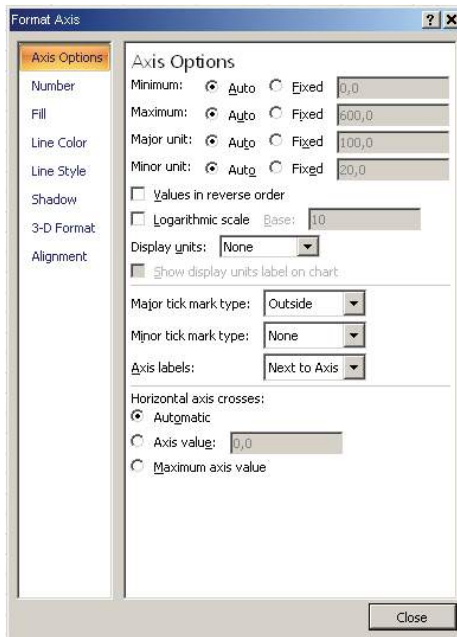
Figure 88: Axis Settings.

The dialog box "Format Axis" will open, and here you can set a lot of different things. You can include adjustable scale, colour and number formats, among other things.

In the left side of the box the settings are saved under different categories.

3. Ensure the category **Axis Settings** is chosen.

Here you can set the scale on the axis. In this case we will just change how high the scale goes.

4. At "Maximum" select **Static** instead of **Automatic**.
5. You can now type in the field to the right, and there you must type 400.
6. Click **Close**.

Your chart has now changed. The scale was smaller, and your columns became taller as a result. Some of them are so tall that they grow out of the chart
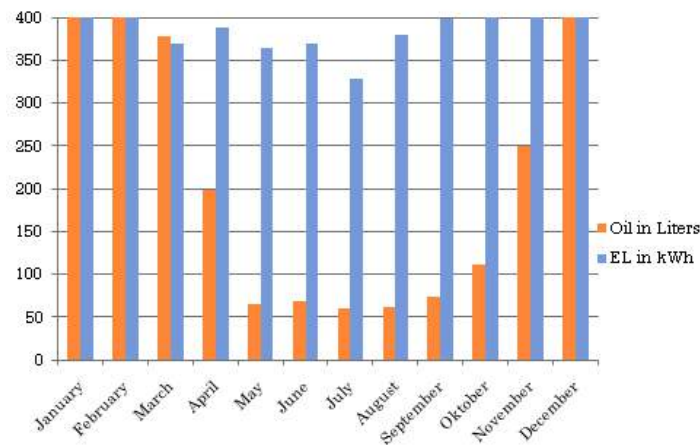
Figure 89: The chart with a different scale.

This is the risk of having a fixed scale, so you should think carefully before you choose this option.

7. We will also use the chart in the next exercises. So, right-click the value axis again, click on **Format Axis** and change the scale to **Automatic** again.

Two Value Axes Each with its Own Scale

In some cases it might be a good idea to have two different value axes. In our diagram we show the oil and electricity consumption in the same chart, and both datasets use the same value axis. The figures for oil and electricity are rather close to each other, so in our chart it is not a problem, but one is not always so lucky

In many apartments heat consumption is calculated by counters located on the radiators. Many know this system as counting "units", and you might only use 50 units a month instead of 300 litres of oil.

In our chart it would cause problems, since the columns of heat would be very short and difficult to compare month for month.

1. For the next exercise, I ask you to change the data form, so it will look like Figure 92. The title "Oil in Litres" must be changed to "Heat Units", and the figures must also be changed. The chart adapts automatically.

Download free eBooks at bookboon.com

We need a new axis for the heat units, since the columns are a little too short to look proper.

2. Click on one of the value columns.
3. In the Ribbon, choose the **Layout** Tab, then click on the **Format Selection** button, located to the far left on the Ribbon.
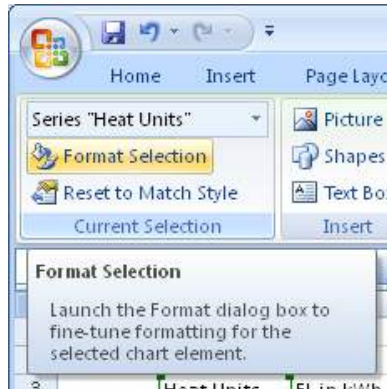

Figure 90: The **Format Selection** button.

This gives you the option to change all kinds of setting for the "Heat Units" data series.
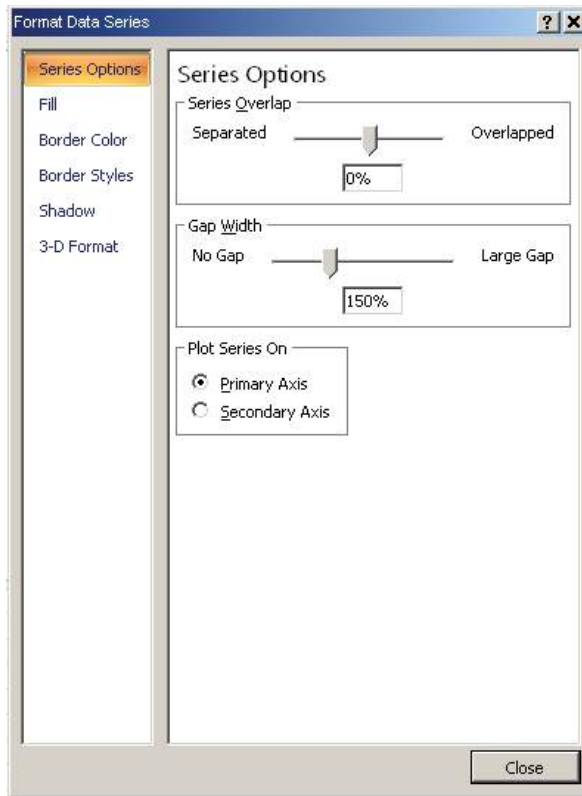
Figure 91: Series Settings.

You can experiment with fill colour, border colour and shadows when we are done with the exercise.

4. Ensure **Series Settings** is selected in the left side of the box.
5. Under "Plot series on", select **Secondary Axis**.
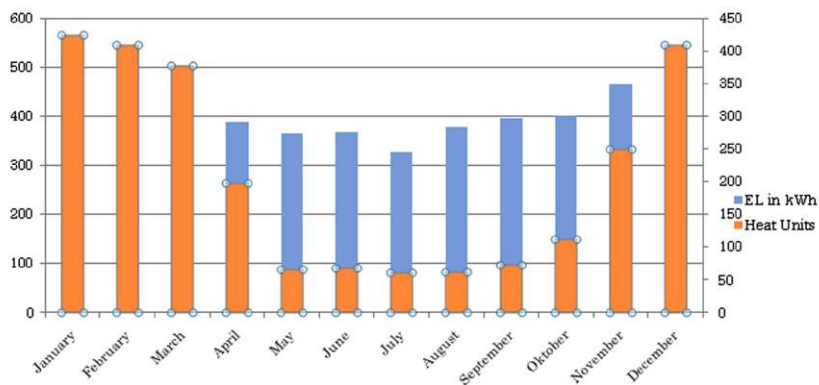6. Click on **Close**.

Figure 92: The chart with a secondary axis.

Now the chart looks like the chart in Figure 92 There is an additional scale on the right side, but there are also some less fortunate things. The scale of heat units is correct, but Excel has decided that the blue bars now should be located on top of the red bars. This means that there are some red bars that you cannot see because they are shorter than the blue ones! This was *not* what we asked for. All we wanted was an extra axis.

Things like that happen occasionally in even the best programs. We have actually found an error in Excel! As I prepared this exercise, I tried various tricks to rectify the error, but Excel insists that, when you have two value axes, the columns stand on top of each other.

But where there is a will there is a way. Sometimes you have to be creative and find an alternative solution. We will therefore turn the chart into a "line chart" in the next section!

7.2   Line Charts

Line charts works exactly like bar charts, but instead of pillars to visualize values Excel creates points connected by lines.

We continue where we left off in the last exercise. The exercise went wrong because we found an error in Excel. Therefore we will begin this section by turning a bar chart into a line chart.

1. Click somewhere on the chart.
2. Choose the Layout Tab in the Ribbon.
3. Furthest to the left in the Ribbon there is a grouping of buttons called "Current Selection". The top button is actually a "scroll box" where you can choose between different things. You must ensure that it shows "Chart Area". If it does not, click the small arrow to the right and select **Chart Area** on the list.

This little exercise ensured that you have selected the whole chart and not just a data series, an axis or a single bar. When we change the chart type for the entire chart, the entire chart must be selected. Later, we will try to make a combined chart.

4. Choose the **Design** Tab in the Ribbon.
5. Click on the **Change Chart Type** to the far left in the Ribbon.
6. Choose the **Line** category in the left side of the box that opens up.
7. In the right side of the box, click on the first chart in the row beneath the headline "Line" (see Figure 93).
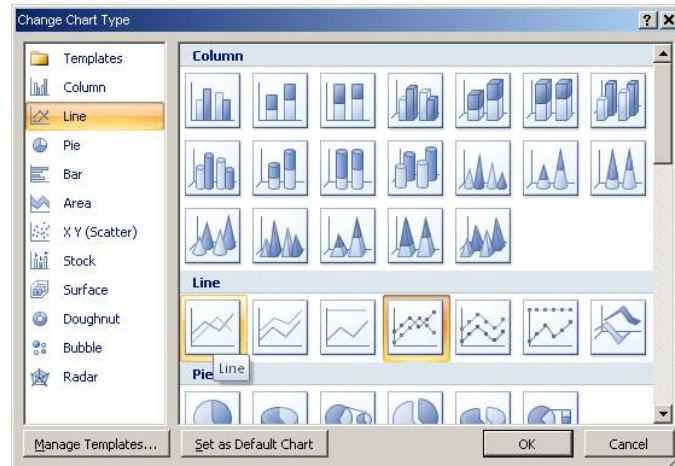8. Click on **OK**.

Figure 93: The line charts are located in the **Line** category.

You have now transformed the entire chart into a line chart. The disadvantage is that the settings are now reset again, so you no longer have a secondary axis. If you like, you can put a secondary axis in again. It should look like this:

Figure 94: line chart with two axes.

7.3   Charts with both Columns and Lines

You are not limited to either bar charts or line diagrams. In Excel, you can actually both have your cake and eat it!

You can select a chart type for each data series. However, that only makes sense when the chart types are compatible. It makes no sense to combine a line chart with a pie chart, as we shall see later.

We will now change the line chart back to a column chart.

1. Click on a place in the line for electricity consumption.
2. In the Ribbon, Click the **Design** Tab.
3. To the left in the ribbon, click the **Change Chart Type** button.
4. In the box that opens, choose **Column** in the Category list to the left.
5. Now click on the first column chart in the right side.

When you select a single data series, it will be the only data series that is turned into another chart type.
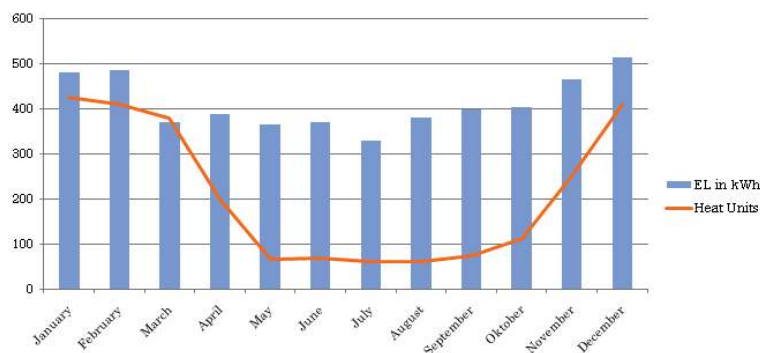

Figure 95: Combine line and bar chart.

In the next section, we will work with some other chart types. If you like, you can proceed with bar and line charts and find out how to add colour and effects.

7.4   Circle Charts

Circle charts, also called pie charts, are useful to describe the size of different values in relation to each other. Unlike bar and line charts, pie charts are not suitable for describing your electricity consumption over time.

To perform the next exercise you must create a spreadsheet in the same way as in Figure 96. The spreadsheet is a simplified monthly budget for a family's recurrent expenditures.

Figure 96: Starting point of the exercise.

In a pie chart, we can illustrate what the costs are compared to each other.

When the spreadsheet is ready, you must activate one of the cells in the table.

1. Click on the **Insert** Tab in the Ribon.
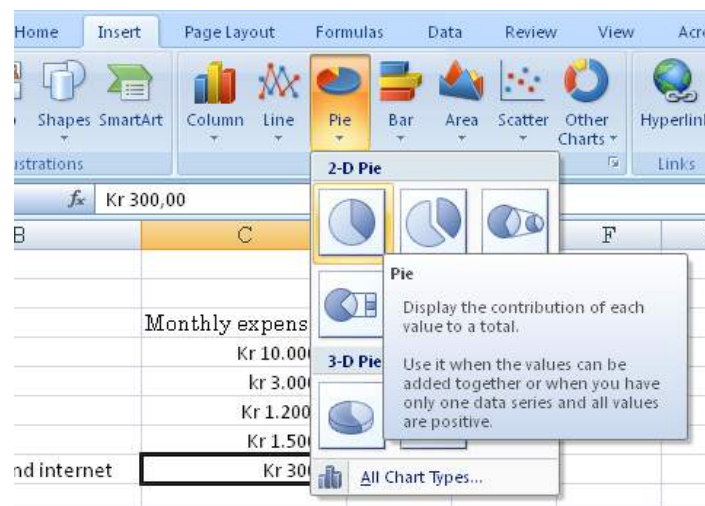2. Click on the **Circle** Tab in the Ribbon.

Figure 97: The **Circle** Tab.

3. Click on the 2-D circle top left in the menu that appears.

After a brief moment, you have a circle chart where the various items in the budget have become pieces in a "pie".
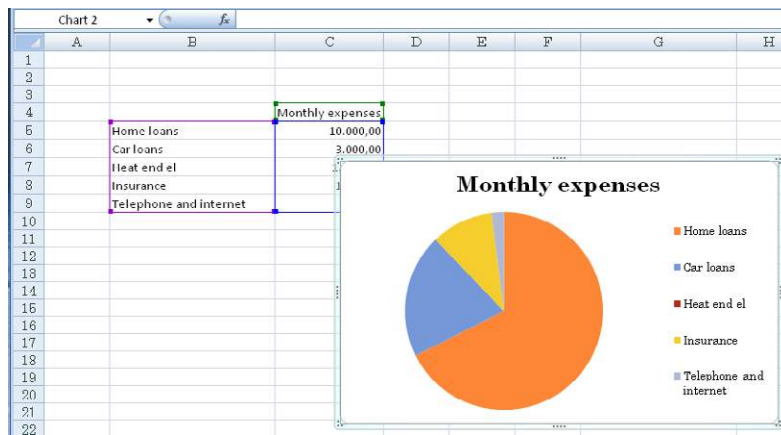

Figure 98: A circle chart.

As you can probably see, it is a good visual way to illustrate where the money goes. What you cannot see is how much money it is. We might also like to add some percentages.

Figure 99: The Circle chart with data labels.

4. Ensure the chart is selected.
5. In the ribbon, choose the **Layout** Tab.
6. On the Tab there is a group of buttons called "Labels". Click on the Data Labels button.
7. A menu appears where you must click on the menu item called **Outside**.

Now the amounts are plotted in the chart, but it will also be very illustrative to put some percentages on them. Some people like pies, while others like numbers better.

8. Right-click on one of the data labels, for instance the one that says "Kr. 10.000,00".
9. In the menu that appears, choose **Format Data Labels**.

A box will open where you can set everything concerning the data labels. Like so many other boxes in Excel, the options are organised in categories, which you can choose from in the left side of the box.
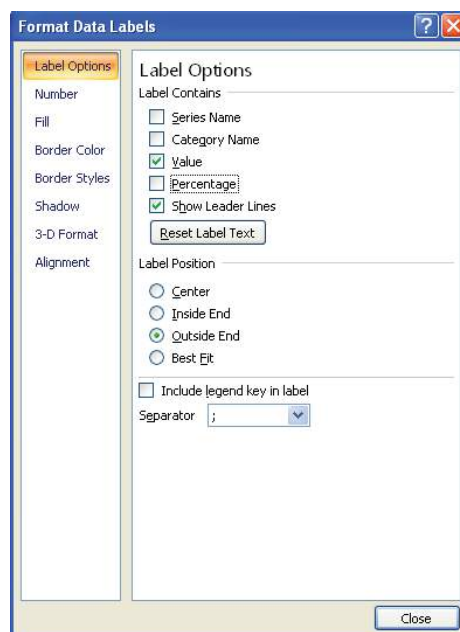

Figure 100: Format data labels.

10. Ensure the category **Label Settings** has been chosen.
11. Under the header "Label Contains", tick **Percentage** and leave the others as they are.
12. Click on **Close**.

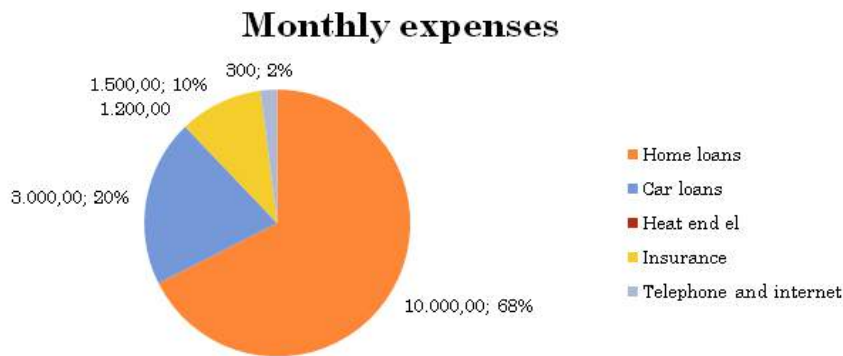Now you have both amounts and percentages in the chart, which gives a lot of inormation about our household budget.

Figure 101: Data labels with percentages.

Now I suggest that you experiment a little with your circle chart. Try changing chart type to a 3D pie chart. 3D circle charts look good, and unlike bar and curve charts the beautiful effect does not affect readability in a circle chart.

7.5 Scatter Charts

Scatter charts are also called "X-Y" charts. If you are a mathematician, you have probably already figured out what an X-Y chart does; it shows values of Y as a function of X. Or put another way, you can show that some values are dependent on others.

To be fair, you can also do that in a bar or line chart, but the scatter chart is different. In the bar and line charts, the horizontal axis is not a scale, but a "category axis". It represents fixed points present in the data table. Each row of the data table corresponds to a point on the horizontal axis of the chart. In the scatter chart, the axis scales in relation to the values appearing in the data table, and the values in the data table may not even be ordered. On the downside, you cannot use values such as January, February, etc. in a scatter chart. All values must be numbers.

If your values on the horizontal axis are in sorted order and have the same interval such as 10, 20, 30, 40, etc. you can use an ordinary line chart. But with the scatter chart, the horizontal axis can also assume negative values.

The scatter chart is therefore suitable for displaying results of measurements where, for instance, you measure the density of a material in relation to temperature. You may also to some extent use scatter charts to show graphs for mathematical functions.

There are features in Excel to show graphs of a mathematical expression, but by creating a table with a lot of values for x, and a lot of values for f(x) you can make such a graph nonetheless.

7.5.1   Results of Measurements

In this example, I have made some samples of our consumption of fuel oil for heating the house in relation to diurnal temperature outside. The samples are carried out on some random day during the autumn of 2007. I have set a table with my measurements and would like to visualise the results with a scatter chart. I want to show how much oil we use in relation to outside temperature. The horizontal axis should be the temperature, and the vertical axis should be oil consumption in litres.

1. Make a spreadsheet as shown in Figure 102.

Figure 102: The starting point of the exercise.

2. Select cell region C3:D12. The dates are not relevant in this chart.
3. Click on the **Insert** Tab in the Ribbon.
4. Click on the **Scatter Chart** button.
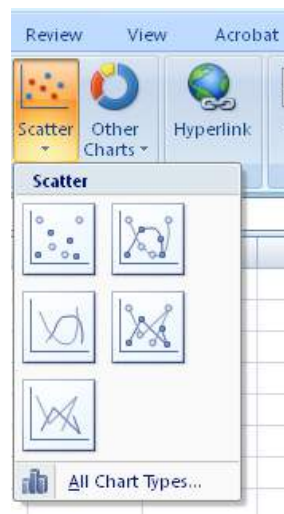5. In the menu that appears, choose the chart type top left (see Figure 103).

Figure 103 the **Scatter Chart** button.

We now have a scatter chart with a temperature scale at the bottom and the corresponding oil consumption plotted into the graph as points.

Here you can really see the difference between line charts and section charts, since measurements in the data table have not been arranged according to temperature. Excel has done that for us in the chart.

7.5.2   Graphic Representation of Mathematical Expressions

As previously mentioned, you can also use the scatter chart to display graphical representations of mathematical expressions. Excel is not really designed for this and there are other programs better suited for this task.

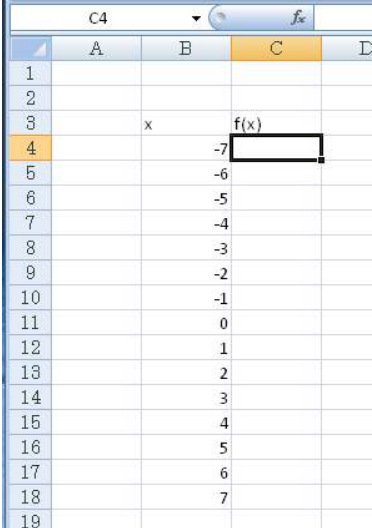But for lack of better you can still use Excel.

In our example we will try to show a graph of a second quadratic polynomial, which is a nice parabola.

The expression we want to display is:

$$f(x) = 3x^2 + 2x - 3$$

We will try to show the graph for x-values between -7 and +7.

1. Start by creating a spreadsheet as shown in Figure 104.

Figure 104: The starting point for the exercise.

2. In cell C4, write the formula =3*B4^2+2*B4-3, and press ENTER.
3. Copy cell C4 to cell region C4:C18.

Now we have a table with two columns. One column has the X-values and the other has the function of the X-values. Now we can create a scatter chart, but this time we choose a chart where the points are connected.

4. Activate one of the cells in the table.

5. In the ribbon, choose the **Insert** Tab.

6. Click on the **Scatter Chart** button and choose the chart type top right.
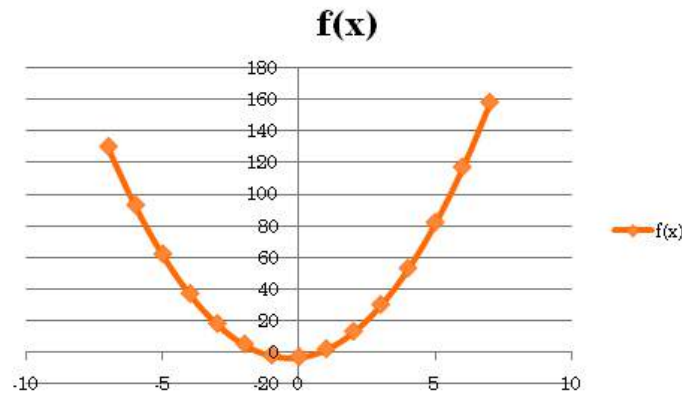
Now we have our parabola.

Figure 105: Excel is not able to draw a parabola, but if we use the program creatively it is possible to get around that problem.

Download free eBooks at bookboon.com

Excel has several types of charts, and there are also three-dimensional versions of the chart types we have worked with here. I encourage you to experiment with the different types of chart. Not all possibilities are examined in this book, but you are now aware of everything you need to continue on your own.

7.6   Chart Sheet

If you do not want the diagram inside the spreadsheet, you can place it in a separate chart sheet. It will then get its own sheet tab at the bottom of the screen.

1. Create a chart in a spreadsheet or use one from a previous exercise.
2. Right-click on the chart and click on the menu item **Move Chart**
3. In the window that opens. Select **New Sheet** and name it. In Figure 106, I call the new sheet "Parabola".
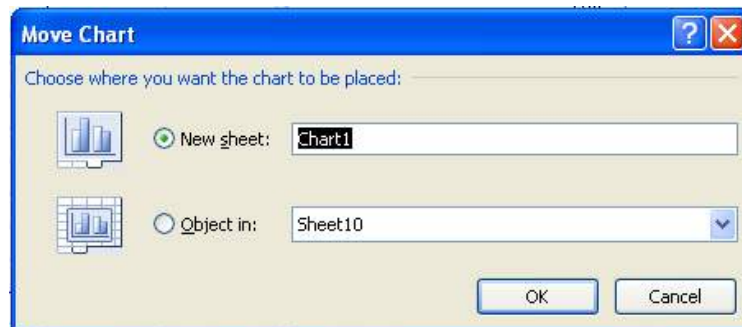4. Click **OK**.

Figure 106: Move Chart.

The chart disappears from the original spreadsheet, and a new sheet tab has appeared, which in my case is called "parabola".

7.7   Viewing and Printing

Viewing and printing is perhaps not so important compared to learning how to do spreadsheets, but when you start working more seriously with it, you will discover that there are some possibilities that are good to know about.

7.7.1   Printing

Of course, you can print your spreadsheets, but often you will find that it requires a little adjustment and alignment before you get a satisfactory result. It is not something that should cost you sleep at night, because when you have learned a few tricks, it is not a problem.
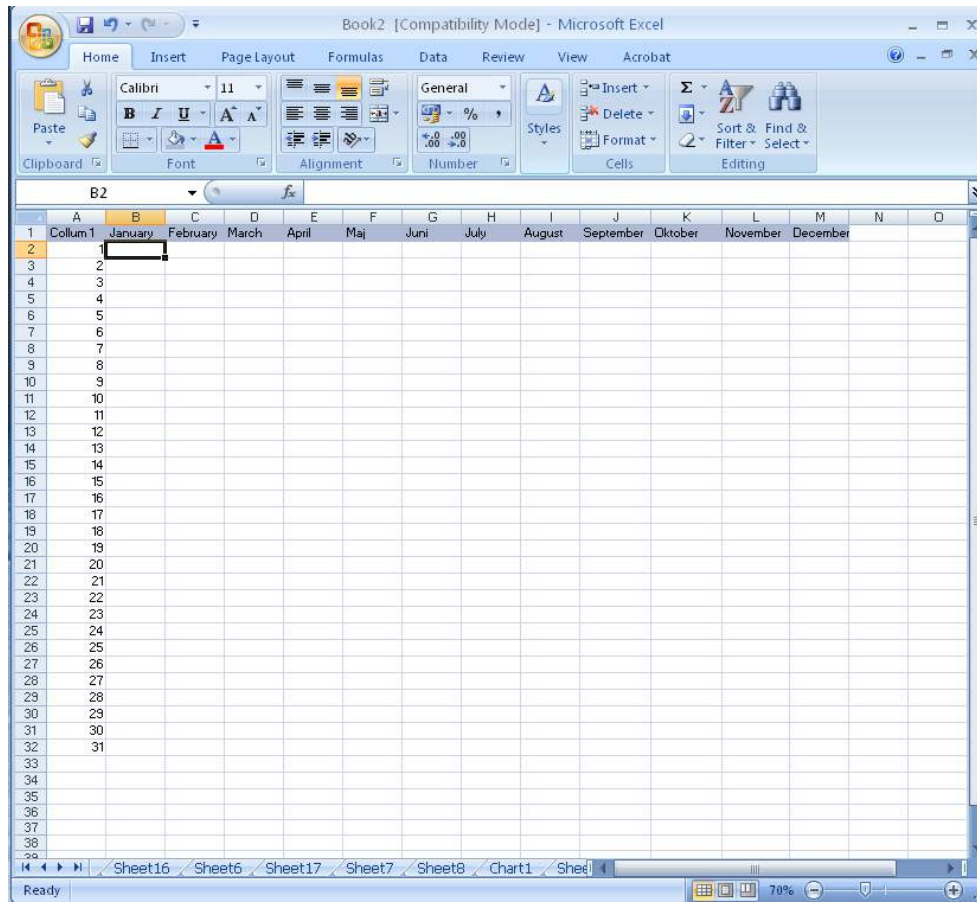
Figure 107: A large table.

In Figure 1017 there is an example of a table that takes up a lot of space. If you like, you can create a similar table, so you can practice yourself. Content is not so important as long as you have roughly the same number of rows and columns as in the example.

7.7.2   Print Preview

I always use the "Print Preview" function before I print. "Print Preview" shows what the printout will look like when it is sent to the printer.

1. Click on the **Office Button**, point to the menu item Print, then click on Print Preview.
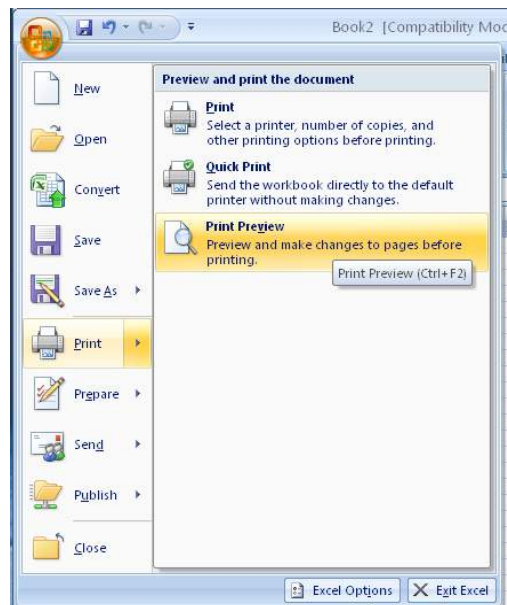

<p align="center">**Figure 108**: The **Print Preview** function.</p>

Now you will see an image of how the print will look with the current settings.

In our example in Figure 109, it is clear that the transcript is not optimal. The table in the spreadsheet has 13 columns, but only seven of them are displayed. If you scroll down with your mouse, you get to page 2 where the rest of the table is displayed.
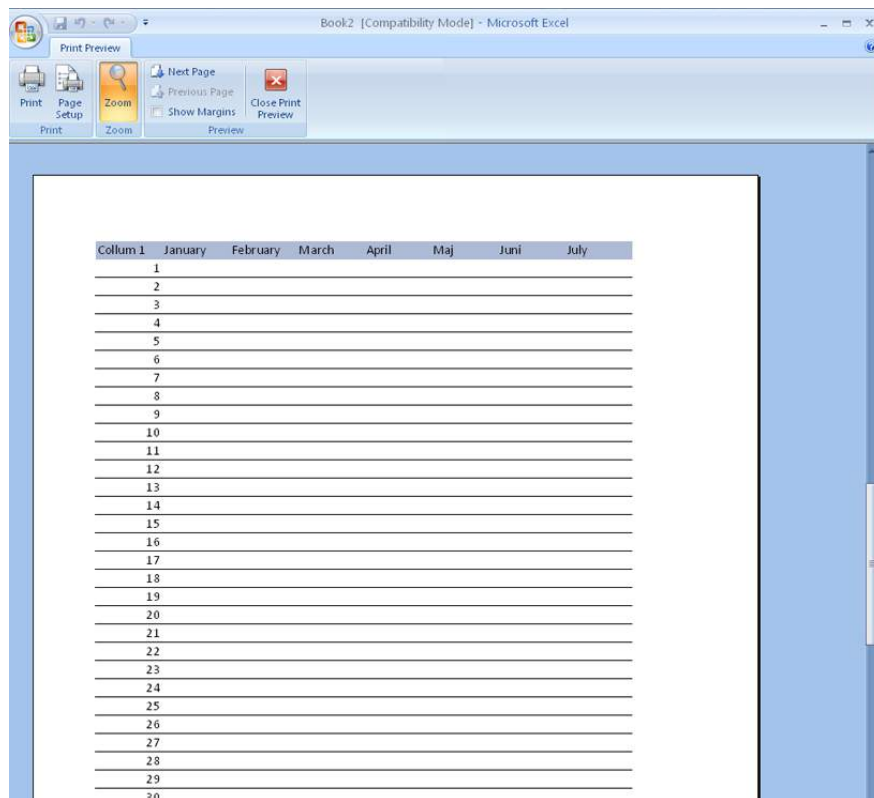
Figure 109: The "Print Preview" window, where you can see that the table does not fit on one page. In the bottom left corner you can see that the printout takes up two pages.

7.7.3   Page Setup

We need to change some settings. Fortunately, you can adjust a lot of different things. For instance, you can scale down. The content of the spreadsheet must be scaled down so that it fits on one page. You can also adjust the margins and add headers and footers, which are text elements that appear at the top and bottom of each page of the transcript.

Finally, you can also set the number of rows and columns to be repeated on all pages. It is especially helpful if you need to print a table with many rows, since you can view the column headers on all pages of the transcript.

2. In the Ribbon, click on the **Page Setup** button.

The "Page Setup" window opens and from here you can control the various options.
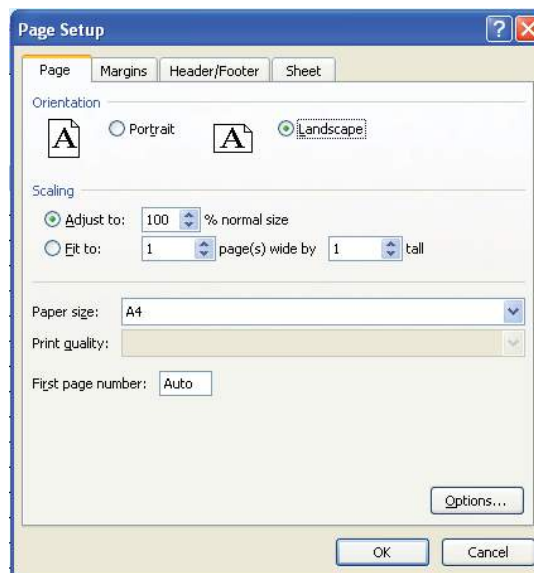

Figure 110: The "Page" Tab.

The window is divided into four different tabs called "Page", "Margins", "Header/Footer" and "Sheet".

In the "Page" Tab you can choose the orientation, ie. choose between portrait and landscape paper format. You can also select the scaling of the content. The default scaling is 100%, but you can adjust it up and down manually until you get an outcome that suits you.

3. In this exercise, let Excel find an appropriate scaling by simply indicating that Excel must adapt the content in width and height to a specified number of pages in landscape format. In our case we will probably get a suitable result by selecting one page wide by one page in height landscape format.
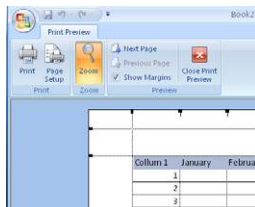

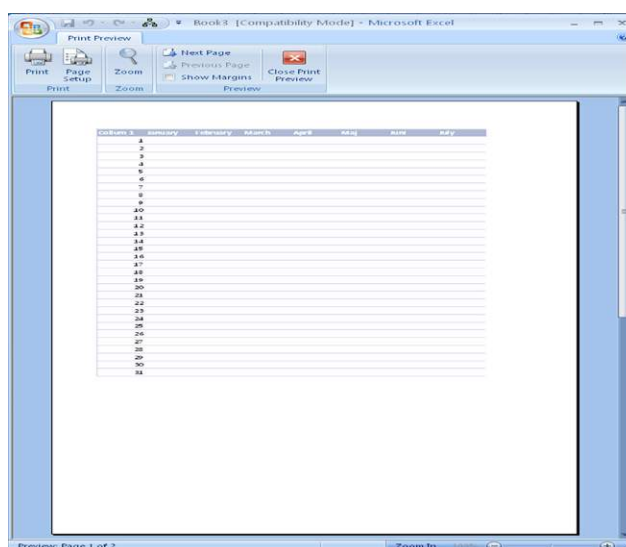**Figure 111**: Visual setting of margins.

Figure 112: Our table with settings as shown in Figure 110.

It is not always enough to scale the pages to get an appropriate result. Sometimes you need to precisely define where the page breaks should be. You will learn that in the next section on "viewing".

The "Margins" Tab in the "Page Setup" window is. Of course you can set how big the margins should be in centimetres. This can also be done in another way. If you close the window "Page Setup" and set a marker at the display margins on the tape, you can adjust the margins visually using the mouse. I think this is easier to work with.

The "Header/Footer" Tab allows you to display a fixed text at the top and bottom of each page of the transcript. This text could be company name, author, etc. But you can also add some text fields which automatically show the date, page number and filename.

The "Sheet" Tab is used to set what must be printed. You do not always want to print everything, and it may be necessary to repeat some rows or columns on all pages. Most settings in this Tab are not available if you opened the window "Page Setup" from within "Print Preview".
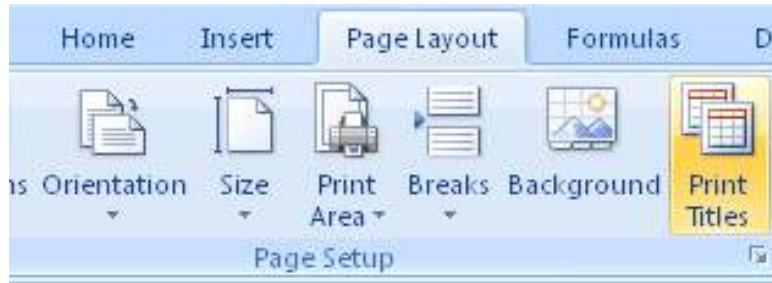

Figure 113: The **Printout** button.

4. Therefore, you must close "Print Preview".
5. To get into "Page setup" again, click the **Page Layout** Tab in the Ribbon, then click the **Print Titles** button. It is a bit of a long way to go, but Excel can also be like that sometimes.
6. You can now choose the **Sheet** Tab again, if you have not already done so.
7. In Figure 114 I have set Excel to repeat number 1 and column A. This of course does not matter if I have already chosen that Excel should adjust everything to one page, but it was only meant as an illustration, and we will need it later for an exercise in the Section "View" below.
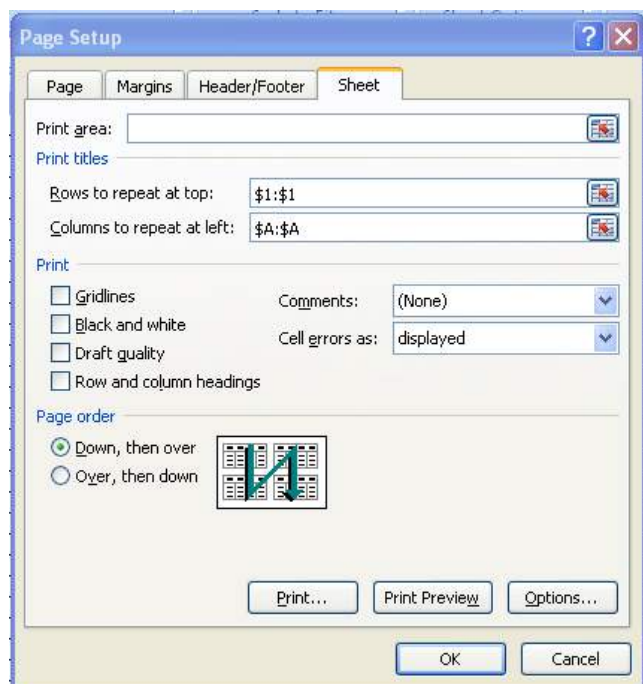
Figure 114: Row 1 and column A are repeated on all pages with this setting.

8. Click **OK**.

7.8   Viewing

So far, our exercises have taken place in "Normal View". This is the standard way to display spreadsheets, and it is nicer when you work in the spreadsheet. But there are a few other useful views you can use before you print your sheet.

If you have a large spreadsheet you need to print, the result may well be somewhat disappointing because spreadsheets tend to spread out over several pages. In the section on printing, you learned that you can scale the printout to fit into a specific number of pages, but you also have the opportunity to control exactly where the page breaks should be.

The display buttons are located at the bottom right on the screen. You can get to he same features by clicking on the **View** Tab in the Ribbon, but the display buttons at the bottom are always visible, allowing you can save a mouse click.

The display buttons consist of three buttons and a "zoom slider". The "zoom slider" works by clicking the mouse and dragging to the right or left to zoom in and out respectively. I prefer instead to hold down the CTRL key on the keyboard while I scroll up or down with the scroll wheel on the mouse. It is a much easier way to zoom in and out, in my opinion, and this method can also be used in many Windows programs.

Figure 115: The display buttons.

The other three view buttons switch between **Normal**, **Page Layout** and **Show Page Breaks**.

We are already familiar with **Normal**, since it is the view we have been using in all our exercises so far. This is the best view when you just have to work with the spreadsheet without caring about the print layout.

Page Layout shows something similar to the result if you print out the spreadsheet. You also get that if you choose **Print Preview** from the Office Button, but in page layout view, you can still work in the spreadsheet. However, the view is not nearly as accurate as **Print Preview.**

Show Page Breaks are the most useful alternative view, since it also adds an important functionality. Here you can see and adjust what should and should not be printed. You can insert and rearrange page breaks and exclude certain areas from being printed.
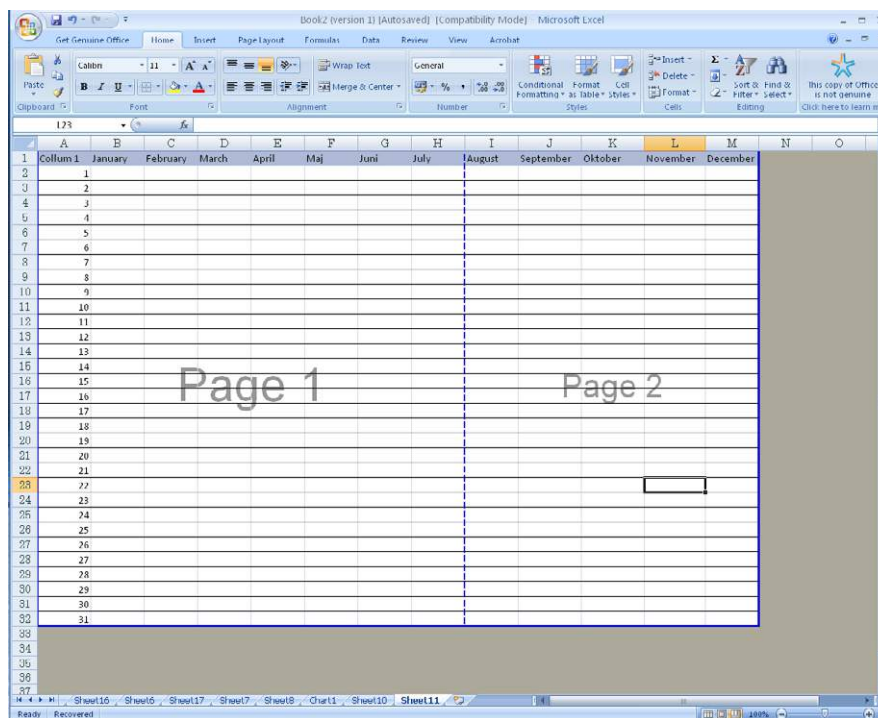
7.9   Adjust Print Range

Figure 116: The view **Show Page Break**.

1. Clik on the **Show Page Break** button to display the same screen as in Figure 116.

In the example in Figure 116, I have changed the page setup from the previous exercise, so the scaling is 100% again. Page layout is still landscape format. The repetition of the first row and column has also been disabled.

The table is surrounded by a thick blue border, which defines "printable area". Only those cells that are in the frame will be printed. You can, by pointing to the frame with your mouse and holding the left mouse button, move the frame. That way you can also exclude some of the table for printing, if that is what you want. You can also have several separate areas in the spreadsheet as a part of the print area. To illustrate this, it requires that our example be extended with a couple of extra tables.

2. Click on the view button **Normal**, and add a few tables like the ones shown in Figure 117. Also add some text in some other cells that you do not want printed.
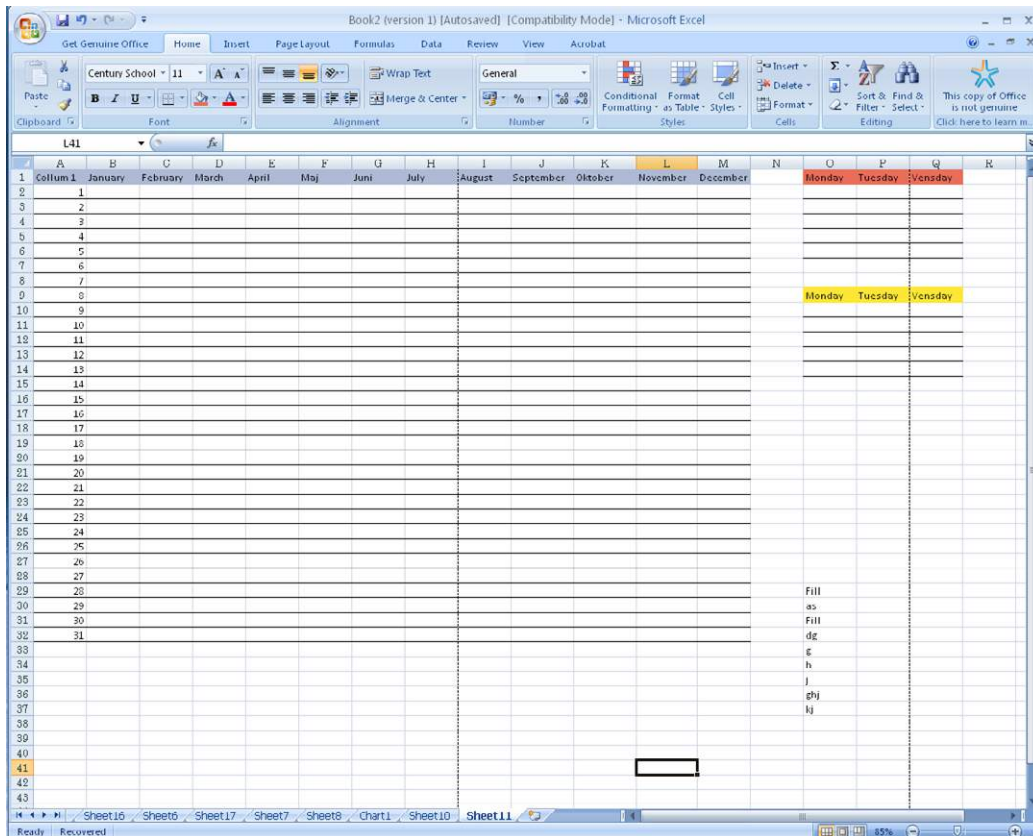
Figure 117: Expansion with a few extra tables and a cell area that we do not want printed.

3. Change to **Show Page Breaks** again.

You can still see that the original table is inside the white area, which means that it will be printed. But the new tables are outside the printable area and will therefore not be printed

If you have several different areas in the same spreadsheet that you want printed, you can hold down the CTRL key on your keyboard while you select the different areas with the mouse. When you are finished selecting fields, click the right mouse button on one of the areas and select the menu item Set Print Area:

4. Hold down the CTRL key while you select all three tables with the mouse. Do not select that which you do not want to print.
5. Right-click on any of the highlighted areas and click the menu item **Set Print Area**.

We now have a "composite print area" and the spreadsheet will look like Figure 118.
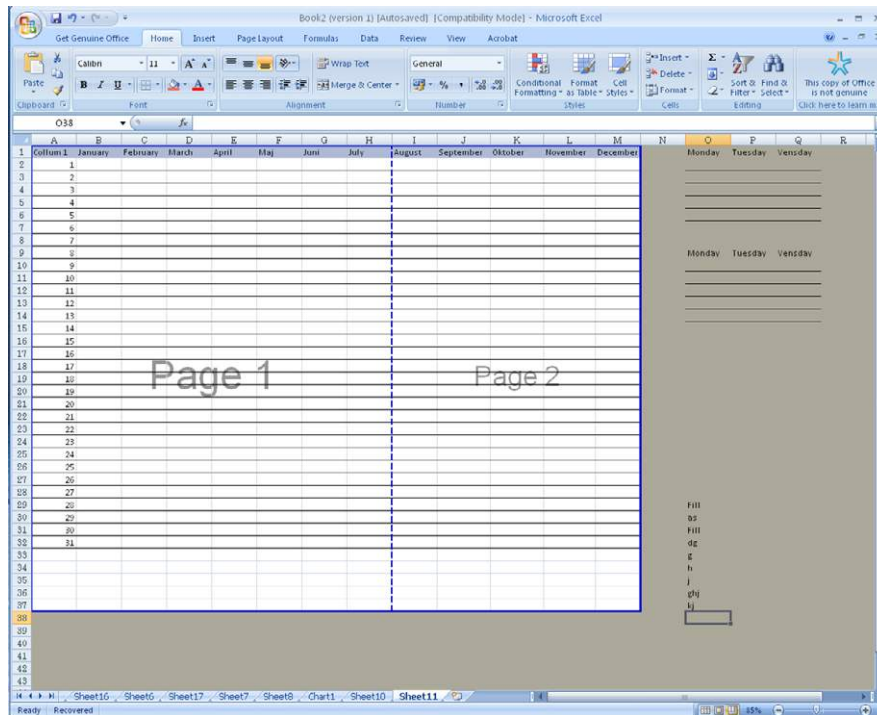
Figure 118: Page Breaks View with the new tables in the grey area.

Composite printing areas are an advantage if you only want certain fields written out, for example some nice tables and charts. You can have some intermediate calculations in the spreadsheet that you do not want in print.

7.9.1   Managing Page Breaks

In our exercise, there is an automatic page break down through the multiplication table. It is signified by a dotted blue line. Excel decides where the automatic page breaks should be, and your spreadsheet might show something else. It depends on the cell heights and column widths, but it also depends on your printer and its configuration.

To gain more control over where the page breaks are, you can insert permanent page breaks. Fixed page breaks will not move, and if you put them in the right places, you can avoid unfortunate automatic page breaks.

Insertion of fixed page breaks is always on the left and above the cell which is active. Our multiplication table in the example would obviously spread out over two pages. In my spreadsheet the table was divided by an automatic page break between the columns for October and November. I would like the shift to be between June and July, so I make H1 the active cell.

1. In your spreadsheet, activate the cell, where it says "July".
2. Make sure the **Page Layout** Tab in the Ribbon is selected, and click on the **Shift** button.
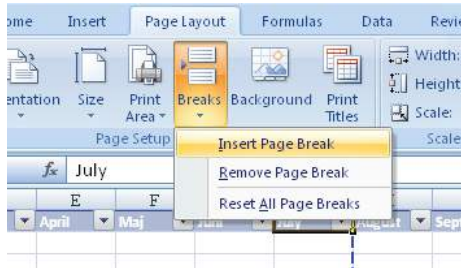3. In the menu that appears, click on **Insert Page Break**.

Figure 119: The **Shift** button.

Now there are no automatic page breaks, and there will not be any unless you make the sheet bigger.
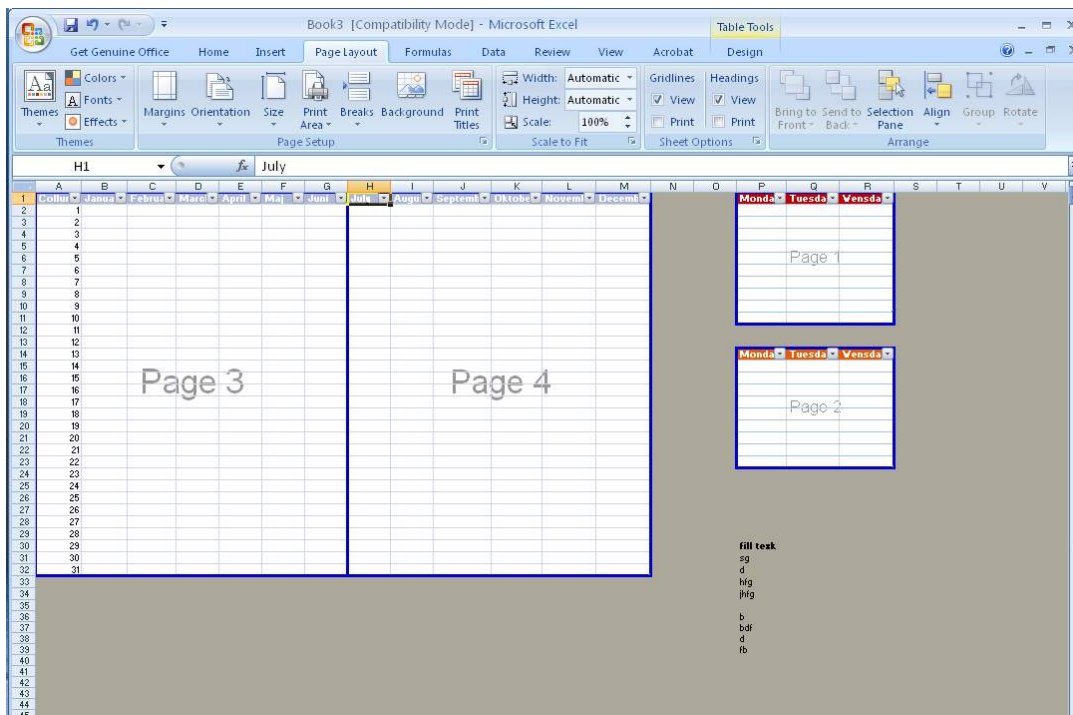

Figure 120: Now the page breaks are fixed.